



## Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at <http://about.jstor.org/participate-jstor/individuals/early-journal-content>.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact [support@jstor.org](mailto:support@jstor.org).

right and applied to right image; slight polarization, outer or right image being brighter.

May 5th, 1859, 8 P.M.—Prismatic parheliion with part of halo on each side of sun distant about  $22^{\circ} 30'$ . Polariscopes applied to left image, held in a parallel plane, eye-mark to left; *medium* polarization, left or outer image brighter. Instrument held in same plane and applied to right image, eye-mark to right; similar *medium* polarization, outer or right image brighter.

May 6th, 1859, 6.50 P.M.—Prismatic parheliion and part of halo on each side of sun distant  $22^{\circ} 20'$ . Polariscopes applied to left image and held in a parallel plane, eye-mark to left; *medium* polarization, outer or left image being brighter. Instrument held in same plane, eye-mark to right, and applied to the right parheliion; similar *medium* polarization, right or outer image being brighter.

May 20th, 1859, 8 P.M.—Prismatic arc of halo to left of sun distant about  $23^{\circ}$ . Polariscopes applied, held in the parallel plane, eye-mark to left; slight polarization, the outer or left image being brighter.

August 7th, 1859, 7.30 P.M.—Prismatic parheliion to right of sun, distant about  $22^{\circ} 30'$ . Polariscopes applied, held in the plane of a line joining sun and parheliion; a little more polarization than in last observation. Arrow and brighter image both to the right.

#### XIV. "Notice of 'The Royal Charter Storm' in October 1859."

By Rear-Admiral ROBERT FITZROY, F.R.S. Received June 21, 1860.

(Abstract.)

The author commenced with some remarks on the recent progress of meteorology, on its advances towards precision and consistency as a science, and the comparative certainty and confidence with which it may now be relied on in its practical applications. He adverted also to the measures now systematically adopted by the Meteorological Department of the Board of Trade and by the Admiralty for promoting simultaneous meteorological observations at various places, and for obtaining accurate registration of atmospherical conditions at sea and on land in many parts of the world; and drew attention to

the steps taken by these public departments for diffusing practical knowledge concerning the laws of winds and storms, and of weather in general, among mariners and others more especially standing in need of such information, as well as to the practice now followed, of lending trustworthy meteorological instruments to commanders of ships able and willing to make an adequate return in the shape of accurate meteorological records, and of supplying other such aids, of a kind specially suited to their wants, to various of the most exposed and least affluent fishing villages.

Notice was then taken of some of the more important practical results derived from meteorological inquiry,—especially the remarkable fact, now fully established, of the constancy of barometric pressure between five and ten degrees of north latitude; the phenomena of cyclones, and the explanation afforded of their production, following Dove's theory of polar and equatorial currents in the atmosphere.

In treating of the main subject of his communication, the "Royal Charter Storm" and the severe gale of the first two days of November last, the author made use of illustrative diagrams, which were exhibited to the Meeting. Of these, four, of large size, showed successive phases of the storm on the 25th and 26th of October; the first at 9 A.M. and the second at 3 P.M. on the 25th; the third at 3 A.M. and the fourth at 9 A.M. on the 26th. These were intended to show simultaneous or synchronous direction and force of wind over a certain area within a few minutes of time, any noteworthy difference of longitude having been allowed for. Smaller diagrams, in like manner, showed simultaneous direction and force of wind from the 22nd of October to the 2nd of November. In both cases the direction was indicated with reference to the true meridian, and the force according to estimation only, which, however, was checked by many comparisons with velocities and pressure instrumentally obtained at the observatories of Greenwich, Cambridge, Oxford, Wrottesley, Liverpool, and at other well-known establishments. The same charts also showed curves of barometric pressure and curves of temperature. These diagrams or charts were compiled by Mr. Babington, assisted in copying by Messrs. Patrickson, Simmonds, and Symons; but notwithstanding the large amount of materials already made use of in their compilation, the author observed that

none of them, nor indeed any part of the work, could yet be considered as nearly complete, and that much matter would still be added as, from time to time, information might be obtained from various sources.

The storm of the 26th of October was first noticed in accurate records, and measured by instrumental observations, in the Bay of Biscay, near Cape Finisterre in Spain. This particular tempest did not come from the west, but from the south-south-west, true.

Successive barometric effects of the storm were traced by similar means in that direction from S.S.W. to N.N.E. across England, from the Channel through Cornwall, across the central southern counties and Lincolnshire, over the North Sea to between the Shetland Isles and Norway.

By referring to these charts and the diagrams, it will be seen that the lowest barometer and a corresponding or simultaneous lull prevailed over ten, fifteen, or twenty miles consecutively in the direction pointed out. But at the time that this comparative lull existed there was around this centre, by some called a vortex (but it can hardly be appropriately so termed, because there was no central disturbance), only variable wind or calm for a short time in the middle of the space, which was about ten or fifteen miles in irregular area.

The wind obtained a varying velocity of from 60 to 100 miles an hour at a distance of from twenty to about fifty miles from this space, and in unequal eddyings crossed England towards the north-north-east, the wind blowing from all points of the compass around the lull. When at Anglesea the storm came from the north-north-east, in the Straits of Dover it was from the south-west; on the east coast it was easterly; in the Irish Channel it was northerly, and on the coast of Ireland it was from the north-west.

The charts show that this circulation or cyclonic commotion was passing northwards from the 25th to the 27th, being two complete days from the time of its first great strength in the "Chops of the Channel," while outside of this circulation the wind became less and less violent; and it is very remarkable that even so near as on the west coast of Ireland there was fine weather with light winds, while in the British Channel it blew a furious northerly and westerly gale.

At Galway and at Limerick on that occasion there were light

winds only, while, as already stated, over England, the wind was passing in a tempest, blowing from all points of the compass around a central lull.

The next storm that occurred was similar in its features, though it came from a rather different direction.

It raged on the 1st and 2nd of November, and its character was in all respects like that just described, now usually called the "Charter Storm."

Coming more from the westward, it passed across the north of Ireland, the Isle of Man, north of England, and then across the North Sea towards Denmark. Further than that distance facts have not yet been gathered, but in the course of time they will be obtained and collated.

The general effect of these storms was felt unequally in our islands, and much less inland than on the coasts.

Lord Wrottesley has shown by observations made at his observatory in Staffordshire, that the wind is diminished or checked by its passage over land; and, looking to the mountain ranges of Wales and Scotland, rising 2000, 3000, or 4000 feet above the level of the ocean, we see they must have great power to alter the direction and probably the velocity of wind, independently of alterations caused by changes of temperature. The very remarkable similarities of this storm of the 1st and 2nd of November, that of the 25th and 26th of October, the series of storms investigated by Dr. Lloyd during ten years, and the observations of Mr. William Stevenson in Berwickshire, require special notice on this occasion. There is no discrepancy between the results of the ten years' investigations published by Dr. Lloyd in the Transactions of the Irish Academy, the three years' inquiry published by Mr. William Stevenson, and all the investigations which have been brought together during the last four years. They all tell the same story. Dr. Lloyd only found in ten years one instance of even a partial storm which differed, namely, one that came from the north in the *first instance*.

Storms from the south-west are followed by sudden and dangerous storms from the north or east, and these are the storms that do most damage on our coasts. Upon tracing the facts, it is proved that the storms which come from the west and south come on gra-

dually, but that storms from the north or east begin suddenly, and at times with extraordinary force.

The barometer, with these north-eastern storms, does not give so much warning upon this coast, because it ranges higher than with the wind from the opposite quarter. But though the barometer does not give much indication of a north-eastern gale, the thermometer does, and the now well-known average temperature of every week in the year affords the caution. The temperature being much above or below the mean for the time of year shows whether the wind will be northerly or southerly—thanks to Mr. Glaisher's discussion of the Greenwich observations for temperature.

To revert to a few of the signs which preceded the "Charter Gale." For a few days before that storm came on, the thermometer was exceedingly low over all the country; there were north winds in some places, and a good deal of snow; though there had been a great deal of exceedingly dry and hot weather previously. These anomalies require consideration; and it may be mentioned that everywhere in these islands, for days before that time, from the 22nd to the 25th of October, barometers were very low. Many days preceding the Charter storm, an extraordinary clearness in the atmosphere was noticed in the north of Ireland; the mountains of Scotland were never seen so prominently as they were in the few days preceding those on which the great storm took place. Every one is aware that last summer was remarkable for its warmth. It was exceedingly dry and hot. All over the world, not only in the Arctic, but in the Antarctic regions, in Australia, South America, in the West Indies, Bermudas, and elsewhere, auroras and meteors were unusually prevalent, and they were more remarkable in their features and appearances than had been noticed for many years. There was also an extraordinary disturbance of currents along telegraph wires. They were so disturbed at times, that it was evident there were great electric or magnetic storms in the atmosphere, though they could be traced to no apparent cause.

Probably these electric disturbances were connected with a peculiar action of the sun upon our atmosphere. Submarine wires, as well as electrical wires above ground, were unusually disturbed, and these disturbances were followed within two or three days by great commotions in the atmosphere, or by some remarkable change.

The question of areas of barometric pressure—or lines (which Espy contends for), namely, long lines from north to south, or from one point direct to another, having been much discussed, the principal object of making the sections, as it were soundings, of the atmosphere which are shown in the diagrams, was to prove whether lines of pressure, or whether areas of pressure prevailed; and in the author's opinion, when they are closely examined they go to prove that while the atmosphere in the British Islands varies in its pressure from time to time, such variation is not along a particular line, but extended over a large and wide area.

As remarkable exceptions to the force of these particular storms, it may be noted that at some places there was little or no wind; although the barometer fell much, without any consequence but rain. The wind circulating around these districts did not affect them, while at other places the storm was tremendous.

The following few details are given respecting the data on which the diagrams have been constructed:—

*The probable limits of error of the barometric curves on the synoptic charts, 21st October to 2nd November, 1859.*

1. *Observations quite correct.*—The observations at the regular observatories, such as Greenwich, Oxford, Cambridge, Wrottesley, Highfield House, Kew, &c., have had all corrections applied, and have been reduced to sea-level, and the temperature of 32° Fahrenheit.

2. *Error probably very small, less certainly than half a tenth.*—The returns from members of the British and Scottish Meteorological Society (nearly ninety in number) have been corrected for height above sea-level, within a few feet; and the corrections of instrumental errors with reductions to 32° have been applied.

*Observations probably within a few hundredths of an inch.*—The continental observations, collected from Dutch papers and from the "Moniteur," have been reduced to 32°, and have also been corrected for instrumental errors.

The heights of some stations are known, and the corrections due to those heights have been applied, while others are but little, if at all, above the sea-level.

Any error in laying down curves from these data can scarcely have exceeded two or three hundredths of an inch.

3. *Observations less accurate.*—The heights of the stations of some observers are not known so nearly. Other corrections have been applied only in a few cases,—the observations sometimes recorded only to the nearest tenth, as at a few lighthouses, not being deemed sufficiently reliable.

Returns in which the barometrical observations are evidently erroneous (from comparison with other neighbouring and contemporaneous observations) have been rejected.

On the whole it may be safely assumed that the observations from which the curves are laid down are less than a tenth in error.

4. *Lighthouses.*—The heights of the lantern above the sea-level, and of the tower, being known, the heights of the barometers have been ascertained, and corrections for the heights have been applied.

*Comparisons of Wind Scales.*

Sea.	Wind.	Land.
0 to 3	Light	0 to 1
3 to 5	Moderate	1 to 2
5 to 7	Fresh	2 to 3
7 to 8	Strong	3 to 4
8 to 10	Heavy	4 to 5
10 to 12	Violent	5 to 6

Wind. Pressure lbs. (avoirdupois).	No. (land scale).	Velocity. Miles (hourly).
$\frac{1}{2}$	1	10
5	2	32
10	3	45
21	4	65
26	5	72
32	6	80

These comparisons of scales have been used in the wind charts, and have been found convenient as well as sufficiently accurate.